

**APPLICATION FOR A UNITED STATES PATENT**  
**UNITED STATES PATENT AND TRADEMARK OFFICE**

Title: Energy Management Head Restraint Insert

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## **FIELD OF INVENTION**

This invention relates to head restraints in motor vehicles. More specifically, it relates to a safer head restraint and manufacturing thereof by utilizing a floating insert to increase head restraint stiffness and energy management without necessarily changing the  
5 foam or posts of traditional head restraints.

## **BACKGROUND OF INVENTION**

Today, most, if not all, motor vehicles come with seats equipped with head restraints. Head restraints provide not only comfort for riders but also are there to protect an occupant's head and neck in case of an accident.

10 Many current head restraints use U or M shaped posts with foam covering the posts. These head restraints simply have the foam interior molded around the posts. See U.S. Patent No. 6,120,100 for an example. A problem with this design is that the foam is often times too soft and does not provide adequate structure within the head restraint. In the event of a rear impact, the head may penetrate too deeply between or above the post  
15 structure, increasing the forces on the neck. A more uniform loading surface is desired to control head displacement in all potential areas of head contact.

Comfort requirements can work against safety recommendations of using stiffer foam to reduce head movement during a crash. A method of reducing head penetration without significantly changing the comfort of the head restraint is greatly desired. It  
20 should also be noted that the application of this type of insert to a seat with an integrated head restraint (also known as a high-back seat) serves a similar benefit. In this case, the posts are replaced by some other seat back structure.

Regulatory actions are mandating that head contact surfaces return to within a small distance of the initial position after load-deflection tests are completed. Soft foam has a slow recovery time. As a result, many head restraints do not meet some safety standards imposed on motor vehicle manufacturers.

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## **SUMMARY OF INVENTION**

The object of this invention is to overcome the above-mentioned problems with current head restraints. A floating insert of a somewhat rigid material would help reduce neck injuries and help meet safety regulations.

Accordingly, this head restraint comprises a post, foam, an insert, and trim cover.

10 Alternatively, the head restraint may be integrated and supported by some other seat back structure. The insert is placed so that the insert will cover a majority of the surface area on the front face and top of the head restraint. The insert may be held in place for manufacturing by any number of existing or new methods. Foam is then applied over the insert and post, if present. The insert may have holes designed to allow foam to  
15 completely fill the area around it. A trim cover is typically applied over the head restraint, but the requirement of a cover is optional.

This invention solves the above-mentioned problems by using an insert that possesses good elastic properties. This insert in head restraints provides a more uniform stiffness and energy management without having to change foam or posts in current head  
20 restraints. It will also provide a more uniform loading surface for an occupants head. Unlike many inserts that are rigidly attached to the post or other seat back structure, this insert is allowed to move relative to the structure under test or crash conditions. This action controls the acceleration of the head to reduce the peak magnitude while

simultaneously minimizing the penetration. The effect is to reduce forces and moments on the neck as well as to reduce the head rotation relative to the torso.

For the foaming process, the insert may be held into position relative to the post by clips over the post. These clips are designed in a manner that provides little resistance to the movement of the insert under head impact conditions. Alternatively, when a post is not present, removable locating pins may be used in the foaming process to position the insert.

Additionally, the elasticity of the insert would help head restraints to meet the deflection criteria for backset retention and height retention. The insert will assist the foam recovery so that the foam will return to acceptable limits within a reasonable time after the loading event.

### **DESCRIPTION OF DRAWINGS**

FIG. 1 is a side cross-sectional view of the head restraint.

FIG. 2 depicts the method of using locating pins to keep the insert in place while the foam is being poured.

FIG. 3 depicts a rear view of the method of using clips on the insert to keep the insert in place.

FIG. 4 depicts the action of an occupant's head on impact and the way the insert assists with controlling head and neck movement.

FIG. 5 is a top view of the occupant's head on impact and the use of the insert to help control head and neck movement.

FIG. 6 is a view of the seat insert located in a high-back seat.

## **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

With reference to FIG. 1, this invention comprises a post 4, foam 6, an insert 8, and trim cover 14 creating head restraint 2. This insert 8 that is the object of this invention will be sized to fit any variety of head restraints. Generally, head restraints use  
5 an M or U shaped post but the insert 8 can be designed to fit any shaped post.

The insert 8 is molded into the foam 6 on the front side of the post 4 at some nominal distance below the surface of the head restraint 2. The insert 8 needs to be buried within the foam 6 so that the head restraint 2 still is comfortable for occupants. This insert 8 also needs to cover a majority of the front surface area and top of the head  
10 restraint 2. The insert 8 could also be formed to fit a variety of head restraint contour designs. Additionally, the insert 8 can comprise of plastic, metal, or a composite material. The versatility of the designs for this insert 8 allow it to be used in most if not all head restraints.

The insert 8 is not meant to be rigidly attached to the post 4. The safety feature of  
15 this insert 8 works best when the insert 8 floats inside the foam 6. However, the insert 8 must be able to stay in place while the foam 6 is molded over the post 4 and insert 8. In one embodiment of this invention, seen in FIG. 3, the insert 8 is fashioned with clips 10. These clips 10 hold the insert 8 in place over the post 4. Then the foam 6 is poured over the insert 4 and post 6. These clips 10 are strong enough to hold the insert 8 in place but  
20 weak enough to break away when impacted by occupant's head. By the clips 10 being able to break away, this still maintains the object of the insert 8 that it floats in the foam. The trim cover 14 envelopes the post 4, foam 6, and insert 8.

Another embodiment of this invention, seen in FIG. 2, is that the insert 8 utilizes locating pins 12. The locating pins 12 would mate with holes in the insert 8 to locate the position of the insert 8 over the post 4. The locating pins 12 would then hold the insert 8 in place while the foam 6 is poured over the post 4 and insert 8. Once the foam 6 is poured, then the locating pins 12 would be pulled out. The trim cover then envelopes the post 4, foam 6, and insert 8.

FIG. 4 and FIG. 5 show how the head restraint insert 8 aids in controlling the motion of an occupants head and neck in cases or rear impact. This controlled motion helps to reduce injury that is common in rear impacts.

FIG. 6 depicts another embodiment of this invention. In a high-back seat, there is not a separate head restraint. However, this insert can still be used to protect and occupants head and neck. The insert 8 is simply located in a position near the top of the high back seat so that in cases or rear impact, the insert 8 will provide the same safety features as it would in a separate head restraint.

The above presents a description of the best mode contemplated for carrying out this invention. The claims should not be read as limited to the described order or elements unless stated to that effect. Therefore, all embodiments that come with the scope and spirit of the following claims and equivalents thereto are claimed as the invention.